WATER QUALITY AND USE

Beneficial Use Attainment

Approximately 636.4 stream miles and 24,379.5 impoundment acres within the South Grand Watershed are classified and have designated beneficial uses as presented in Tables G and H of the Rules of the Department of Natural Resources Division 20-Clean Water Commission Chapter 7-Water Quality (Table Wq01) (MDNR 2001b). These streams must meet or exceed established criteria as defined in Table A of the Rules of the Department of Natural Resources Division 20-Clean Water Commission Chapter 7-Water Quality for those beneficial uses (MDNR 1999a). All watershed streams and impoundments listed in Table Wq01 are designated for livestock/wildlife watering as well as protection of aquatic life. Many impoundments within the watershed have additional designated beneficial uses. Eleven impoundments are designated for drinking water; twenty-seven are designated for boating; three are designated for whole body contact recreation; and one impoundment is designated for industrial use. The largest impoundment in the watershed, Harry S. Truman Reservoir, is designated for livestock and wildlife watering, protection of aquatic life, whole body contact recreation, boating, and drinking water supply. The South Grand River is the only stream within the watershed having an additional designated beneficial use. In addition to livestock and wildlife watering and protection of aquatic life, the South Grand River is designated for boating. The designations for the South Grand River are from the river's mouth to Township 44 North, Range 33 West, Section 2; a distance of approximately 48.0 miles.

It is important to note that, while a stream or impoundment may have a beneficial use designation, this designation does not mean that those uses occur on that particular water body or are permitted on that water body.

Section 303(d) of the Federal Clean Water Law requires that states identify their impaired waters (MDNR 2002a). This is accomplished by comparing data from those waters with water quality criteria established for designated beneficial uses of those waters (MDNR 2002a). Waters that do not meet their criteria are then included in the 303(d) list. The state must then conduct Total Maximum Daily Load (TMDL) studies on those waters based on a priority ranking in order to determine what pollution control measures are required to restore those waters to meet their designated uses (MDNR 2002a). Currently, there are 8 streams and 2 impoundments within the South Grand Watershed included in the 1998 303(d) list (Table Wq02) (MDNR 1998a). All streams included on the list, with the exception of Big Creek, have impairments associated with coal mining. Big Creek is included in the list due to excessive sedimentation from agriculture non-point sources. The two impoundments on the list include Truman Reservoir, which is listed because of manganese from natural sources, and Pleasant Hill Lake, which is on the list due to chlordane from urban non-point runoff. At the time of this writing (2003), the 2002 303d list is currently open for public comment and therefore has not been finalized. The draft 2002 303d list for Missouri does include changes from the 1998 listing. More Information can be found regarding the Draft Missouri 2002 303d list on the EPA's Region 7 TMDL website.

In addition to streams listed on the Missouri 303d list, the EPAs Watershed Assessment Tracking and Environmental Results System (WATERS) database includes data for additional streams within the watershed which are believed to be impacted.

Chemical and Biological Quality of Streamflow

Data regarding the chemical and biological quality of stream flow within the South Grand Watershed has been collected by different entities since 1962. Government agencies which have conducted water quality sampling of stream flow within the watershed include the Environmental Protection Agency (EPA), United States Army Corps of Engineers, Missouri Department of Natural Resources, and the United States Geological Survey (USGS). In addition some water quality data has been collected by Stream Team organizations. It appears that no long-term comprehensive stream flow water quality data exists within the South Grand Watershed. Only 4 sites have periods of record for water quality exceeding one year. This fact makes a comprehensive analysis of stream flow chemical quality for the watershed difficult and unreliable.

Due to a lack of comprehensive data as well as the great variation of time periods and parameters between water quality stations within the South Grand Watershed it is not possible to perform an adequate and comprehensive analysis of chemical water quality to be applied to the entire watershed. However, using data from the EPA Legacy STORET Database as well as data from a single USGS water quality station, analysis of some available basic water quality parameters for the time period 1991 through 2000 has been performed for 6 selected water quality stations within the watershed in order to gain an understanding of possible water quality issues within the watershed (Figure Wq01). Parameters analyzed included water temperature; dissolved oxygen; pH; nitrogen, total ammonia; phosphorus; and fecal coliform. It is important to note that all of the aforementioned parameters were not available for all stations. It is also important to note that 3 of the stations occur within the flood control pool of Truman Reservoir and thus experience periodic inundation.

Parameters which had measurements failing to meet state standards for water quality (or, in the absence of a state standard; federal recommendations) included dissolved oxygen and total phosphorus (Table Wq03). Low dissolved oxygen was the most prevalent parameter that failed to meet state standards for water quality within the watershed. Dissolved oxygen levels failed to meet these standards at three of the six stations in a combined 13 of 101 samples analyzed. The only station analyzed for which total phosphorus measurements were available (station 06921881: South Grand River at Grand River Church), exceeded the EPA recommended level in 14 out of 26 observations. This site also exhibited high fecal coliform levels. A relative comparison of fecal coliform levels and total phosphorus levels indicates a strong correlation between the two (Figure Wq02). This would suggest that the high levels of phosphorus are organic in nature, perhaps coming from human or animal waste inputs.

As stated previously, 7 streams within the watershed are chemically affected by pollutants associated with coal mining. These pollutants included low pH and elevated levels of sulfate (MDNR 1998a). Additional, although limited, water quality data for the South Grand Watershed is available from the USGS Historical Water Quality Data Website and the annual USGS Water Resources Data Reports as well as the EPA Storage and Retrieval (STORET) Database. In addition, volunteer water quality monitoring data is available from the Missouri Stream Team online database. Additional State Water Quality Standards are available in the most current document of the Rules of the Department of Natural Resources Division 20-Clean Water Commission Chapter 7-Water Quality.

The Missouri Unified Watershed Assessment designates the South Grand River Watershed as having severe biotic impairment. The causes of this impairment include channel alterations, excessive

nitrification, and toxic metals/chemicals (MUWASC 1998).

Point Source Pollution

Table Wq04 lists 110 municipal and non-municipal waste water and water treatment facilities (not including concentrated animal feeding operations) within the South Grand Watershed (Figure Wq03) (MDNR 1998a, 2000b, 2000c). There are 20 municipal waste water and water treatment facilities within the watershed. The three largest of these are waste water facilities which serve the cities of Harrisonville, Belton, and Clinton, Missouri. Discharges from these facilities have a combined flow of approximately 7.38 million gallons per day.

In addition to municipal and non-municipal waste water facilities, fifteen permitted concentrated animal feeding operations (CAFOs) existed in the watershed between 1988 and 1998 (Table Wq05)(Figure Wq02)(MDNR 1999b). The most prevalent type of operation involved swine production, while the second most prevalent type of operation involved poultry production. The largest facility in the watershed was a class 1B swine facility located on a tributary of Harding Creek. Class 1B facilities are capable of holding 3,000-6,999 animal units. The total animal units at the aforementioned facility were 3,481. Six permitted operations within the watershed were classified as non-point operations with less than 300 animal units.

Non-point Source Pollution

Perhaps one of the more difficult challenges to address within any watershed is non-point source pollution. Whereas point source pollution can usually be traced to a single discharge point or area such as a waste water treatment plant discharge, non point source pollution, such as sheet and gully erosion of topsoil, runoff of nutrients from pastures, or pesticide and fertilizer runoff from fields, is much more difficult to detect as well as remedy. It takes the cooperation of the landowners within a watershed to minimize non-point source pollution and its impacts.

A significant non-point source pollution concern within the South Grand Watershed is soil erosion and the resulting sedimentation. The NRCS (formerly known as the SCS) estimated sheet erosion at 2.5-5 tons per acre per year. While this is considered low for agricultural land, the NRCS rating of gully erosion at 0.3-0.8 tons per acre per year in the watershed is considered severe (MDNR 1992).

The largely agricultural nature of the watershed combined with the channelization of several streams including the South Grand appear to be the most probable factors that have contributed to high levels of gulley erosion in the watershed. The EPA Watershed Assessment Tracking, and Environmental Results Database (USEPA 2003), lists agriculture/crop related sources as "probable sources contributing to" the impairment of 463.6 miles of streams in the watershed. In addition, MDNR (1992) states that "since a much greater relative percent of gully erosion than sheet erosion is delivered to streams, agriculture erosion and sediment deposition in streams should probably be considered a basin wide problem." Channelization within the watershed has likely compounded the problem. Channelization is known to increase bank instability and cause headcutting of the stream channel (Bolton and Shellberg 2001). This can have a reverse domino-effect as headcuts travel upstream increasing bank instability and erosion of tributaries, even in some severe instances causing small drainages in fields to become deep gulleys.

WQ3

Pesticides are another non-point source pollution concern associated with the agricultural aspect of the watershed. It is estimated that approximately 26% of the watershed is cropland with approximately 15% of the watersheds riparian corridor in cropland, leaving little or no buffer for filtering out runoff which could carry pesticides to streams. Figure Wq04 shows percent of acres treated by county for various pesticide types.

Another major non-point source pollution concern within the South Grand Watershed is runoff from mined lands. The MDNR "Incidents of Mines Occurrences, and Prospects" (IMOP) Database contains data on 31 "active" mines and 325 "past producers" within the South Grand Watershed in Missouri (MDNR 2001a). The highest percentage of "past producers" were coal mines followed by limestone (MDNR 2001a). The majority of the coal mines (63%) are surface mines and are located in the lower portion of the watershed. Nearly all (92%) of limestone mines are surface mines. The distribution of coal mines within the watershed is limited to drainages flowing into the lower South Grand, and Truman Reservoir. When compared to other mining activities, coal mines appear to have had the greatest impact on water quality within the watershed. While the physical impacts of strip mining of coal include erosion and sedimentation, chemical impacts include high sulfate concentration, iron and manganese deposits, and acid mine drainage which can decrease the pH of impacted waters (MDNR 2002b). It should be noted that reclamation projects such as the Tebo Creek Project have been carried out on some abandoned mine lands within watershed (MDNR 2003).

As stated previously, 7 streams within the watershed are chemically affected by pollutants associated with coal mining. These pollutants included low pH and elevated levels of sulfate (MDNR 1998a).

As with many other watersheds in the state, livestock, and in particular cattle populations, can potentially adversely affect water quality within the South Grand Watershed. This is especially true when livestock are allowed to linger in riparian zones. Estimated animal unit density (animal units/acre) for the South Grand Watershed based on the 1992 Census of Agriculture was 0.161(MUWASC 1998). An animal unit is equal to "roughly one beef cow or 1,000 pounds live weight" (MUWASC 1998). Much of the livestock population data currently available is based on county estimates. Analysis of United States Department of Agriculture-National Agriculture Statistics Service (USDA-NASS 2000) data indicates that in 1999, counties intersecting the South Grand Watershed had an average of 26.8 head of hogs per square mile and 73.5 head of cattle per square mile. For comparison, the average for counties statewide was 30.6 head of hogs per square mile and 62.4 head of cattle per square mile. While CAFOs, which were previously addressed as point source discharges, accounts for a certain percentage of livestock included in these statistics, the majority of livestock within the watershed are probably pastured. This makes the presence of nutrient filtering timbered stream corridors and limited livestock access to streams important tools landowners can use to minimize the impacts of livestock on water quality.

Runoff from urban and suburban areas as well as urban expansion can result in pollutants such as petroleum products, lawn fertilizers and pesticides, and sediment reaching streams. Approximately 0.4% of land cover in the South Grand Watershed is classified as urban. The majority of this is located in the East Branch of the South Grand and the Upper Big Creek Hydrologic Units due to the presence of Harrisonville and outlying communities of the Kansas City area.

Land disruption from road and bridge construction and maintenance often results in increased sediment loads to receiving water systems. Bridge construction can also result in stream channel modification, which affects stream flow both up and downstream from the bridge. The South Grand Watershed

includes approximately 4,605 miles of road. This is 2.3 miles of road for every square mile of drainage area. Approximately 1,960 miles of these roads are probably unpaved (1.0 mi/sq mi). This is based on the assumption that most county roads not intersecting a municipality are unpaved. According to the Draft Missouri Department of Transportation 2004-2008 Highway and Bridge Construction Schedule, there are currently (2003) four state highway projects tentatively planned which involve drainage and/or bridge construction scheduled within the watershed from 2004-2008 (MDOT 2003).

Water Pollution and Fish Kill Investigations

Thirty one water pollution incidents have been investigated in the South Grand Watershed since 1990 (Table Wq06) (MDC 2003c). The stream impacts associated with these incidents ranged from 0 yards to greater than 26.4 miles, with the impact of one incident unknown. Fourteen of the 31 incidents resulted in fish kills. Half of the fish kills were associated with discharges from sewage treatment facilities, while four of the kills were associated with the operation of Montrose Dam. Prior to 1990, several fish kills occurred due to acid mine drainage (amd) from coal mines located in the lower portion of the watershed(MDNR 2002c, 2002d, and 2002e). Some drainages affected by amd included Big Otter Creek, Barker Creek, and Tebo Creek. While reclamation projects have since been conducted in these watersheds, some release of amd still occurs due to shallow groundwater movement (MDNR 2002c, 2002d, and 2002e).

Unified Watershed Assessment

The Missouri Unified Watershed Assessment Final Report, a cooperative effort of various state and federal agencies as well as the University of Missouri, was completed in 1998. Two purposes of the report were to "identify watersheds that do not meet clean water and other natural resource goals and where prevention action is needed to sustain water quality and aquatic resources" in Missouri (MUWASC 1998) and to rank those watershed in order of priority for restoration action. Ranking was based on a variety of water quality and use criteria. Through this process, the South Grand Watershed was ranked fourth out of 56 category I watersheds in the state. Factors contributing to this ranking at the time of analysis included the following: seven streams and one lake on 303(d); major pollutants (Sulfate and low pH); severe biological impairment due to channel alterations, excessive nitrification, and toxic metals/chemicals; moderate wetland loss; the presence of thirteen public drinking water intakes; 100% of hydrologic unit in public drinking water watersheds; and the presence of a large public drinking water population.

Water Use

Water use data for the South Grand Watershed obtained from the USGS National Water Use Database (1998d) indicates that total water withdrawn from the South Grand Watershed in 1995 was 366.24 million gallons per day (mgd). Most of the water withdrawn from the watershed was from surface water sources. Surface water withdrawn from the watershed was 362.99 mgd while groundwater withdrawn was 3.25 mgd.

Estimated water withdrawal for thermoelectric power generation purposes was the most prevalent use within the South Grand Watershed in 1995 (USGS 1998d). Withdrawals for this purpose were entirely from surface water source(s) and totaled 354.9 mgd. This accounts for 97% of all withdrawals in the watershed. Withdrawals for livestock was the second most prevalent within the South Grand Watershed equaling 2.39 mgd. Table Wq07 lists water withdrawals by use category for additional uses in the South Grand Watershed.

There are 15 surface public drinking water intakes within the South Grand Watershed (MDNR and CARES 2003a). Thirteen of these intakes are active. These intakes serve the cities of Adrian, Archie, Creighton, Garden City, and Harrisonville as well as Henry County Public Water Supply Districts 2 and 3 both of which receive water from Truman Reservoir. Of the active surface intakes, 9 are lake intakes and 4 are river intakes (Figure Wq05).

Major water use information for the South Grand Watershed was obtained from the MDNR, Division of Geology and Land Survey. The MDNR maintains records of "major" (those facilities capable of withdrawing 100,000 gallons/day or more) surface and ground water users throughout the state. Recent records (2001) indicate there were a total of 31 major water users withdrawing nearly 2 billion gallons of water from 76 groundwater and surface water wells and/or intakes combined in 2001 (Table Wq08)(MDNR 2003b). Nearly all water (99.9%) was acquired from surface water sources with the remainder coming from ground water sources. Most surface water use (99.9%) and overall water use (92.8%) was associated with Truman Lake hydroelectric operations. Withdrawals by government entities accounted for 99.9% % of water use in the watershed.

Recreational Use

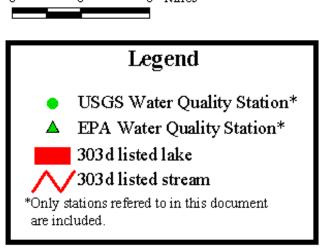
<u>In 1982</u> the South Grand River Watershed was ranked 27 out of 37 major watersheds in Missouri for recreational value (MDC and MDNR 1982). Results were obtained by surveying professional staff from six state and federal agencies. In the views of respondents, the main problems facing the recreational standing of the watershed included poor land use, intensive agriculture, channel modification, and impoundment respectively. Chemicals and flooding by Truman Reservoir were additional problems mentioned.

While there are 8 public areas having 21.4 miles of permanent streams within the watershed, there are only three public stream accesses all of which are located on the South Grand and only one of which has a developed boat ramp. Low base flows plus the lack of developed public stream access points within the South Grand Watershed are two of limiting factors to public stream use.

Much of the aquatic oriented recreational use within the watershed is associated with Truman Reservoir. Between 1990 and 1997 (no data for 1993 and 1996) anglers took an average of 40,467 fishing trips per year to Truman. Crappie was the most sought after fish with average estimated hours per angler per year at 17.2. Black bass were the second most sought after fish with average angler effort at 7.6. Average hours spent fishing for other fish were as follows: white bass (0.8), catfish (0.7), walleye (<0.1), hybrid striped bass (<0.1), and sunfish (<0.1). It is important to note that these figures are estimates for the entire Truman Reservoir.

Figure Wq01. South Grand River Watershed Water Quality







FigureWq02. Relative comparison of total Phosphorus and fecal coliform levels at USGS Station 06921881 (South Grand River at Grand River Church) for the period 1998-2000

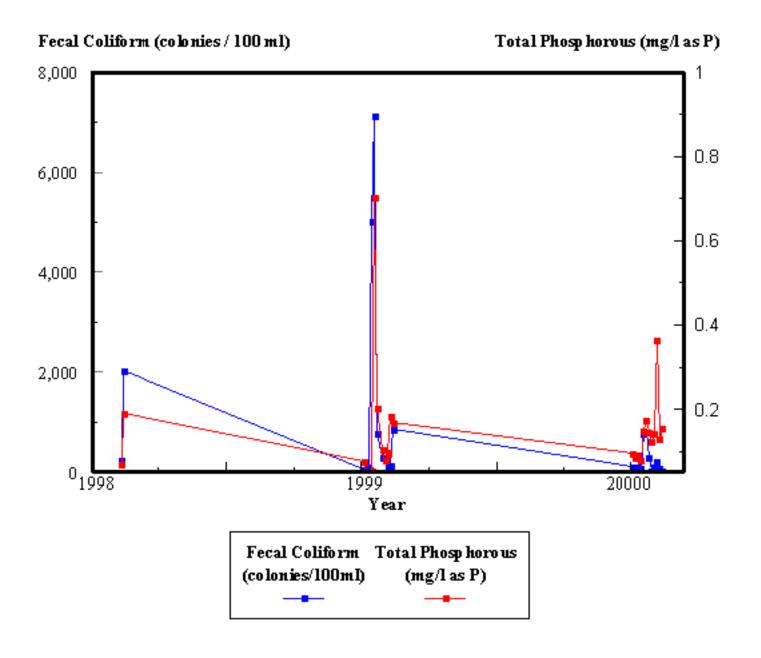
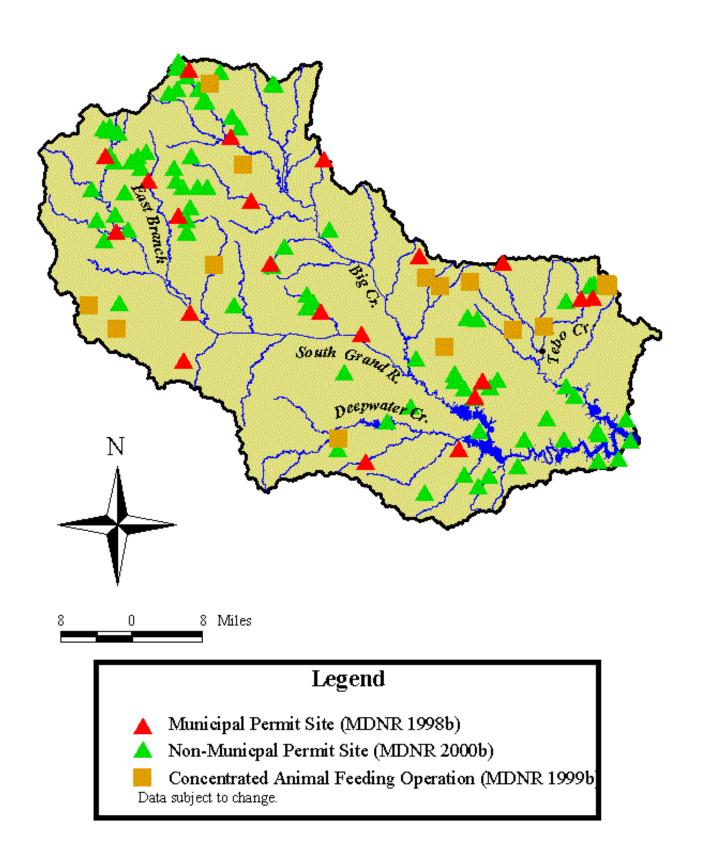
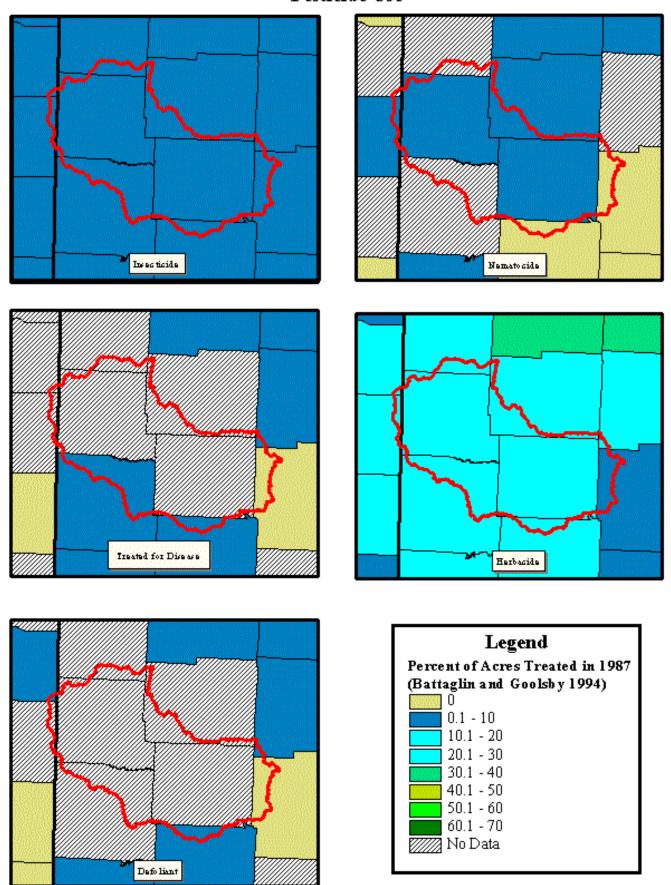


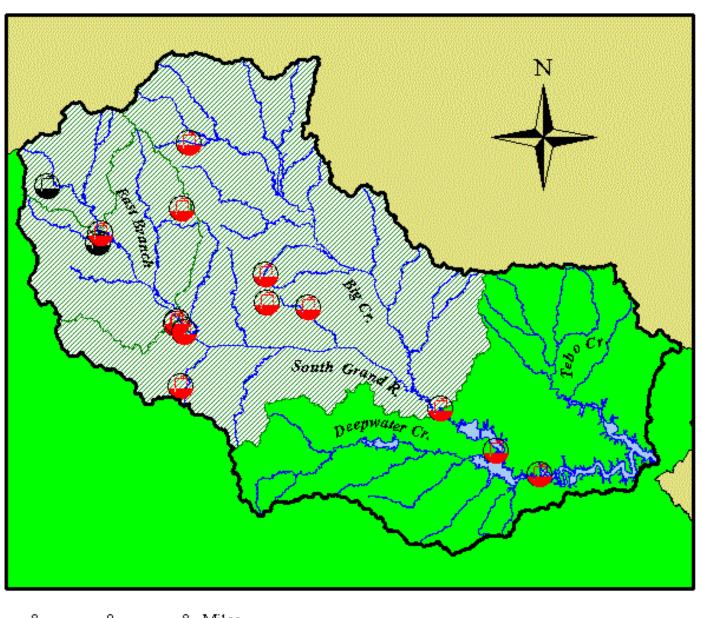
Figure Wq03. South Grand River Watershed Point Source Discharges and CAFOs



South Grand Watershed Pesticide Use



South Grand River Watershed Surface Public Drinking Water Supply





Legend

- Active Surface Public Water Supply Intake (MDNR and CARES 2003a)
- Inactive Surface Public Water Supply Intake (MDNR and CARES 2003a)
- River Public Water Supply Intake Watershed (MDNR and CARES 2003b
- Lake Public Water Supply Intake Watershed (MDNR and CARES 2003b)

Table Wq01. Missouri Department of Natural Resources use designations for selected streams and impoundments within the South Grand Watershed in Missouri (MDNR 2001b). Locations are given in section, township, range format.

		Miles			Designated Use ²
Stream Name	Class ¹	acres*	From	To	
Adrian Lake	L1	26	3,41N,31W		lww,aql,dws
Amarugia Highlands Lake	L3	55	10/11,43N,32W		lww,aql,btg
Annette Lake	L3	65	1,44N,33W		lww,aql,btg
Archie Lake	L1	3.5	SE,SE,28,43N,31W		lww,aql,dws
Bluestem Lake	L3	15	22,47N,31W	22,47N,31W	lww,aql,btg
Bodarc Lake	L3	15	23,47N,31W		lww,aql,btg
Catclaw Lake	L3	42	14,47N,31W		lww,aql,btg
Cleveland Reservoir	L1	8	29,45N,33W		lww,aql,dws
Conner O. Fewell Lake	L3	10		32/29,43N,25W	lww,aql,btg
Coot Lake	L3	22	22,47N,31W		lww,aql,btg
Cottontail Lake	L3	27	14,47N,31W		lww,aql,btg
Creighton Lake	L1	14	NW SE,14,43N,29W		lww,aql,dws
Freeman Lake	L1	13	SW,W18,44N,32W		lww,aql,dws
Garden City Lake	L1	22	31,44N,29W		lww,aql,dws
Garden City New Lake	L1	46	NW,18,43N,29W		lww,aql,dws
Gopher Lake	L3	42	23,47N,31W		lww,aql,btg
Harrisonville City Lake	L1	20	34,45N,31W		lww,aql,btg,dws
Harrisonville Lake	L1	385	SW,W26,46N,31W		lww,aql,btg,dws
HS Truman Lake	L2	55,600 (20,392)	7,40N,23W		lww,aql,wbc,btg,
Jackrabbit Lake	L3	31	15,47N,31W		lww,aql,btg
KC Angler's Club Lake	L3	25	SE18,46N,30W		lww,aql,btg
KC Southern Lake	L3	28	5,43N,33W		lww,aql,btg
Lone Jack Lake	L3	35	14,47N,30W		lww,aql,btg
Luna Lake	L3	17	SE,34,45N,31W		lww,aql,btg
Montrose Lake	L3	1,568	NE,W33,41N,27W		lww,aql,ind
Nell Lake	L3	31	15,47N,31W		lww,aql,btg
North Lake	L3	51	NW,NE28,45N,31W		lww,aql,btg
Peculiar Lake	L3	25	SE,SW,22,45N,32W		lww,aql

Pleasant Hill Lake	L1	115	SW,SE,1,46N,31W		lww,aql,btg,dws
Plover Lake	L3	15	15,47N,31W		lww,aql,btg
Poague Wildlife Area Lake	L3	77	19,42N,26W		lww,aql,btg
Raintree Lake	L3	300	6,46N,31W		lww,aql,wbc,btg
Settles Ford C.A. Lakes	L3	110	9-10,42N,29W		lww,aql,btg
Silver Lake	L3	59	SW,SW,16,46N,32W		lww,aql,btg
Tebo Freshwater Lake	L3	300	SW,SW,25,43N,25W		lww,aql,btg
Windsor City Lake	L3	20	06,43N,23W		lww,aql
Winnebago Lake	L3	350	NE,NW,9,46N,31W		lww,aql,wbc,btg
Designated Impoundment Acres		59,587.5.5 (24,379.5)			
Barkers Cr.	C	13.0	Mouth	09,43N,23W	lww,aql
Bear Cr.	C		Mouth	2,44N,28W	lww,aq1
Bear Cr.	C		Mouth	17,40N,27W	lww,aq1
Big Cr.	P	ļ .	Mouth	Hwy. 150	lww,aq1
Big Cr.	C		Hwy. 150	20,47N,31W	lww,aq1
Big Cr.	P		Mouth	Hwy. 150	lww,aql
Big Deer Cr.	C		Mouth	27,42N,31W	lww,aql
Big Otter Cr.	C		Mouth	31,40N,25W	lww,aql
Black Cr.	C		Mouth	35,43N,32W	lww,aql
Brush Cr.	P		Mouth	19,42N,23W	lww,aql
Brush Cr.	C	l .	Mouth	30,43N,22W	lww,aql
Camp Br.	C		Mouth	28,45N,30W	lww,aql
Camp Br.	C		Mouth	28,45N,30W	lww,aql
Cave Spring Cr.	C	ļ .	Mouth	5,43N,33W	lww,aql
Clear Cr.	C	4.0	Mouth	11,44N,30W	lww,aql
Clear Cr.	C	4.3	Mouth	27,42N,23W	lww,aql
Coal Cr.	P	3.0	Mouth	35,42N,26W	lww,aql
Coldwater Cr.	C	3.0	34,44N,31W	8,43N,33W	lww,aql
Coopers Cr.	C	6.5	Mouth	6,39N,26W	lww,aql
Coopers Cr.	C	6.5	Mouth	6,39N,26W	lww,aql
Crawford Cr.	C	5.0	Mouth	32,46N,29W	lww,aql
Deepwater Cr.	C	8.0	Mouth	Montrose Lake Dam	lww,aq1
Deepwater Cr.	C	12.0	35,41N,28W	18,40N,29W	lww,aql
Deer Cr.	C	0.5	Mouth	12,41N,26W	lww,aql
Ditter Cr.	C	1.2	Mouth	03,41N,23W	lww,aql
Duck Cr.	C	3.4	Mouth	32,43N,23W	lww,aql
E. Br. Crawford Cr.	C	2.0	32,46N,29W	20,46N,29W	lww,aql

E. Fk. Tebo Cr.	C	12.0	31,43N,24W	35,44N,24W	lww,aql
East Br.	C	12.0	Mouth	1,44N,32W	lww,aql
East Cr.	C	7.0	2,44N,33W	31,46N,33W	lww,aql
Eight Mile Cr.	C	16.8	Mouth	36,44N,31W	lww,aql
Elk Fk.	C	4.5	Mouth	35,42N,30W	lww,aql
Elm Br.	C	3.0	Mouth	12,43N,24W	lww,aql
Granddaddy's Cr.	C	1.0	Mouth	26,41N,28W	lww,aql
Harding Cr.	C	2.0	Mouth	15,43N,33W	lww,aql
Harless Cr.	C	2.0	34,44N,31W	28,44N,33W	lww,aql
Honey Cr.	C	10.0	Mouth	24,43N,27W	lww,aql
L. Deer Cr.	C	3.0	Mouth	31,42N,30W	lww,aql
Lick Br.	\overline{C}	6.9	Month	19,43N,29W	lww,aql
Marshalls Cr.	\overline{C}	9.5	Mouth	33,40N,27W	lww,aql
Massey Cr.	C	6.0	2,44N,33W	20,45N,33W	lww,aql
Middle Big Cr.	C		Mouth	Lake Winnebago Dam	lww,aql
Middle Fk. Tebo Cr.	С	6.5	Mouth	6,43N,24W	lww,aql
Mormon Fk.	\overline{C}	13.5	Mouth	19,42N,32W	lww,aql
Mouse Cr.	C	1.0	15,47N,32W	22,47N,32W	lww,aql
N. Deepwater Cr.	\overline{C}	4.0	Mouth	35,41N,29W	lww,aql
Norris Cr.	C	4.0	Mouth	33,44N,27W	lww,aql
Owens Cr.	C	3.0	Mouth	21,43N,32W	lww,aql
Panther Cr.	\overline{C}	7.0	Mouth	15,44N,29W	lww,aql
Poney Cr.	P	3.2	Mouth	13,44N,33W	lww,aql
Poney Cr.	C	9.1	13,44N,33W	State Line	lww,aql
S. Deepwater Cr.	C	1.0	Mouth	20,40N,29W	lww,aql
S. Fk. S. Grand R.	C	10.0	Mouth	34,44N,33W	lww,aql
S. Grand R.	P	48.0	Mouth	2,44N,33W	lww,aql,btg
Sand Cr.	C	15.0	Mouth	12,43N,26W	lww,aql
Sparrow Foot Cr.	C	2.0	Mouth	15,41N,25W	lww,aql
Sugar Cr.	C	15.1	Mouth	33,44N,30W	lww,aql
Tebo Cr.	P	4.0	Mouth	6,42N,24W	lww,aql
Tebo Cr.	C	0.5	6,42N,24W	31,43N,24W	lww,aql
Tebo Cr.	C	3.5	Mouth	19,44N,21W	lww,aql
Tennessee Cr.	\overline{C}	7.0	Mouth	34,44N,31W	lww,aql
Trib. M. Fk. Tebo Cr	C	0.5	9,43N,24W	3,43N,24W	lww,aql
Trib. M. Fk. Tebo Cr	С	0.5	Mouth	5,43N,24W	lww,aql
Trib. M. Fk. Tebo Cr	C	3.5	Mouth	36,43N,24W	lww,aql

Trib. M. Fk. Tebo Cr	C	1.0	17,43N,24W	17,43N,24W	lww,aql
Trib. M. Fk. Tebo Cr.	C	1.0	Mouth	36,44N,25W	lww,aql
Trib. to Barkers Cr.	C	1.0	Mouth	15,42N,24W	lww,aql
Trib. to Big Cr.	C		Mouth	Lake Harrisonville	lww,aql
Trib. to Big Otter Cr.	C	1.0	Mouth	32,40N,25W	lww,aql
Trib. to Brush Cr.	C	1.6	Mouth	15,42N,23W	lww,aql
Trib. to Clear Cr.	C	0.6	Mouth	28,42N,23W	lww,aql
Trib. to Coopers Cr.	C	2.0	Mouth	4,39N,26W	lww,aql
Trib. to Coopers Cr.	C	2.0	Mouth	4,39N,26W	lww,aql
Trib. to East Cr.	C	1.0	Mouth	32,46N,32W	lww,aql
Trib. to Massey Cr.	C		Mouth	33,45N,33W	lww,aql
W. Br. Crawford Cr.	C	12.2	Mouth	21,47N,30W	lww,aql
W. Fk. East Cr.	C	5.0	Mouth	26,46N,33W	lww,aql
W. Fk. Tebo Cr.	C	7.0	Mouth	Hwy. 52	lww,aql
Wades Cr.	C	8.0	Mouth	33,44N,25W	lww,aql
White Oak Cr.	C	3.0	Mouth	28,42N,28W	lww,aql
Designated Stream Miles		636.4			

Note: This table is not presented as a final authority.

L2-Major reservoirs.

L3-Other lakes which are waters of the state. For effluent regulation purposes, publicly owned lakes are those for

which a substantial portion of the surrounding lands are publicly owned or managed.

P-Streams that maintain permanent flow even in drought periods.

C-Streams that may cease flow in dry periods but maintain permanent pools which support aquatic life.

² lww-livestock & wildlife watering ind-industrial

aql-protection of warm water aquatic life wbc-whole body contact recreation

and human health-fish consumption. **btg**-boating & canoeing

dws-drinking water supply **irr**-Irrigation

¹ L1-Lakes used primarily for public drinking water supply.

^{*}Acres given for Impoundments.

Table Wq02. South Grand Watershed impaired streams and reservoirs included in the 1998 303d list of Missouri (MDNR 1998a).

Water Name	County	Miles/	Pollutant	Source	Priority	Schedule
		Acres				
Big Creek	Johnson	49	Sediment	Ag non-point source	Н	2009
Pleasant Hill Lake	Cass	115	Chlordane	Urban non-point runoff	L	2003
Big Otter Creek	Henry/	1	рH	Otter Creek coal area	(2)	2004
	St. Clair					
Honey Creek	Henry	3	Sulfate	Reliant coal area	L	2006
Truman Lake	Bates-	55,600	Manganese	Natural	L	2005
	Benton					
Trib. Barkers Creek	Henry	0.3	pН	Grey coal area	L	2001
Trib. Big Otter Creek	Henry/	1	pН	Otter Creek coal area	(2)	2004
	St. Clair					
E. Fk. Tebo Creek	Henry	1	pН	Triple coal area	L	2004
M. Fk. Tebo Creek	Henry	6.5	Sulfate	Henry 6.5 Sulfate	L	2001
M. Fk. Tebo Creek	Henry	2	pH, sulfate	New Castle coal area	L	2001
W. Fk. Tebo Creek	Henry	7	Sulfate	Spangler coal area	L	2004

Note: Data subject to change.

Priority (for analysis): H= High, L=Low, (2) Reclamation project in progress.

Post-reclamation water quality & 303(d) status to be determined.

Table Wq03. Water quality data for selected stations and parameters within the South Grand Watershed (MDNR 2000c, USGS 2001b). Selection of state standards used for comparison of values at each site are based on the MDNR use designations corresponding to the section of stream sampled and include the following: AQL Protection of aquatic life, HHP Human Health Protection-Fish Consumption, DWS Drinking Water Supply, IRR Irrigation, LWW Livestock and Wildlife Watering, WBC Whole-body-contact recreation, BTG Boating. Note: for lake water quality samples, depth ranges are given in feet.

Station: EPA 009534 (South Grand River) Period: 1994

	Sta	ndard		Measure	
Parameter	AQL	LWW	BTG	Min-Max	Exceedence
Temperature (°F)	90.0				
(warm water fishery)	Max				
pH	6.5-9.0			7.9	0/1
Oxygen, dissolved (mg/L)	5.0			14.2	0/1
(warm water fishery)	Min				
Nitrogen, Total Ammonia	$0.1-50.6^{1}$			0.24	0/1
(mg/L as N)					

Station: EPA 280516 (Gaines) Period: 1993

	Sta	ndard		Measure	
Parameter	AQL	LWW	BTG	Min-Max	Exceedence
Temperature (°F)	90.0			66.2	0/20
(warm water fishery)	Max				
pН	6.	5-9.0			
Oxygen, dissolved (mg/L)	5.0			0.5-5.7	3/5
(warm water fishery)	Min				
Coliform, fecal					
(colonies / 100 ml)					
Nitrogen, Total Ammonia	$0.1-50.6^{1}$				
(mg/L as N)					
Phosophorus, Total ³					
(mg/L as P)					

Table Wq04. Municipal and non-municipal waste water and water treatment facilities within the South Grand Watershed in Missouri (MDNR 1998a, 2000b).

Facility Name	County	Facility	Receiving Stream
A&M Quarries Sani Lan F	Cass	LAN F	Trib. Knob Creek
Adrian WWTF	Bates	POTW	S Fork Big Deer Creek
Amoco Pipeline Co. Freeman	Cass	OPIPE	South Grand R.
Amoco-Freeman Oil Spill/L	Cass	SPILL	Trib. Poney Creek
Angler's Camp	Benton	CAMP	Trib. Harry Truman
Archie WWT Lagoon	Cass	POTW	Eight Mile Creek
Belton WWTF	Cass	POTW	East Creek
Bent Tree Harbor Subd	Benton	SUBD	Trib. Truman Lake
Beyer Crushed Rock Co	Cass	QUARR	Massey Creek
Billy Goat Industries	Jackson	INDUS	Trib. Big Creek
Butterbaugh Mhp	Jackson	MHP	Big Creek
Calhoun WW Lagoon	Henry	POTW	M Fk Tebo Creek
Cass Co Midwy R-I Sch Dis	Cass	SKL	Trib. To Poney Creek
Cass County Pwsd #7	Cass	WATER	Trib. S Grand R
Cedar Glade Subd Wwtp	Benton	SUBD	Trib. Harry S Truman
Cheyennes	Pettis	EATS	Trib. Elm Branch
Chilhowee Municipal WWTF	Johnson	POTW	Br Norris Creek
Clinton Cuntry Club	Henry	SUBD	Trib. Nordston Creek
Clinton WWTP	Henry	POTW	Coal Creek
Const Ind Labor Train Sch	Cass	SKL	East Creek
Country Creek Est WWTP	Cass	SUBD	Trib. L. Harrisonville
Creighton WTP	Cass	WATER	Trib. Knob Creek
Creighton WWTF	Cass	POTW	Trib. Knob Creek
Crown Trailer Sales Inc	Cass	CIRES	East Fk/S Grand R.
Cutler Lagoon	Benton	MOTEL	Trib. Truman Reservoir
Davis R-12 Elem School	Henry	SKL	Trib. Deep Water Creek
Deepwater Municipal WWTF	Henry	POTW	Trib. Truman Res
Dupuis Redi-Mix Concrete	Cass	LIM Q	Trib. Big Creek
Dupuis Redi-Mix Concrete	Cass	LIM Q	E Br Big Creek
E Z Stop Inc	Cass	SER S	Trib. Duncan Branch
Eagle Point Condo	Camden	SUBD	Lake Of The Ozarks
Eagles Nest R.V. Resort	Benton	RESOR	Truman Reservoir
East Lynne WW Stab Lagoon	Cass	POTW	Trib. Camp Branch Creek
Ellis-Scott Sani Landfill	Henry	LAN F	Fields Creek
Fischer Properties-Clinton	Henry	LIM Q	Trib. Dillon Creek
Fischer Properties-Windsor	Henry	LIM Q	Trib. E Fk Tebo Creek

Table Wq05. Concentrated animal feeding operations permitted within the South Grand Watershed in Missouri between 1988 and 1998 (MDNR 1999b).

County	Class	Primary	Total	Receiving Stream
		Waste Type	Animal Units	
Bates	NP	Dairy Cattle	114	
Cass	IB	Hogs	3,481	Trib. Harding Creek
Cass	IC	Hogs	1,966	Trib. Eight Mile Creek
Cass	NP	Hogs	21	
Henry	II	Poultry	623	Middle Fork Tebo Creek
Henry	IC	Hogs	2,595	Honey Creek
Henry	IC	Poultry	2,184	Trib. E. Fork Honey Creek
Henry	II	Hogs	853	Deepwater Creek
Henry	NP	Hogs	256	
Henry	NP	Hogs	33	
Henry	NP	Hogs	240	Trib. E. Fork Honey Creek
Jackson	NP	Horses	200	
Pettis	IC	Poultry	1,092	Trib. E. Fork Tebo Creek
Pettis	IC	Poultry	1,092	Elm Branch
Pettis	IC	Poultry	1,092	Trib. Elm Branch

Class:

Class IB - 3,000 to 6,999 animal unit equivalents

Class IC - 1,000 to 2,999 animal unit equivalents

Class II - 300 to 999 animal unit equivalents

Class NP - Non Point less than 300 animal unit equivalents

Animal Units:

1 animal unit -

1 beef feeder or slaughter animal 0.5 horse

0.7 dairy cow

2.5 swine weighing over 55 lbs.

15 swine weighing less than 55 lbs. 10 sheep

30 laying hens

55 turkeys

100 broiler chickens

Flying J Travel Plaza	Cass	TRU S	Wolf Cr/E Br S Grand
Freeman WWTF	Cass	POTW	Poney Creek
Garden City Municipal WWTF	Cass	POTW	Trib. Panther Creek
Garden City WTP	Cass	WATER	Trib. Panther Creek
Harrisonville Firework Lp	Cass	CONVN	Trib. East Br
Harrisonville WWTF	Cass	POTW	Town Cr
Henry County Pwsd #3-Clinton	Henry	WATER	Pretty Bob Creek
Henry County Sani Landfill	Henry	LAN F	Trib. Big Creek
Henry County Water Company	Henry	WATER	Coal Creek
Hilty Quarries Quarles	Henry	LIM Q	Fields Creek
Hilty Quarries-Brownington	Henry	LIM Q	Big Otter Creek
Hilty Quarries-Montrose	Henry	LIM Q	Trib. Davis Branch
Hilty Quarries-Mt Zion Qu	Henry	LIM Q	Hay Creek
Hilty Quarries-Tightwad	Henry	LIM Q	Sparrow Cr
Hilty Quarries-Urich	Henry	LIM Q	Trib. White Oak Creek
Hilty Tightwad Quarry	Henry	LIM Q	Trib. Truman Res
Inland Rivers Aggregate	Henry	LIM Q	Cooper Creek
KCPL Montrose Station	Henry	STEAM	Montrose Lake
King & King Enterprises	Cass	SER S	Trib East Branch
Kingsville WW Stab. Lagoon	Johnson	POTW	Big Creek.
Lafarge Construction Mat	Henry	LIM Q	Trib. Truman Reservoir
Lakeland R-Iii School WWTP	St. Clair	SKL	Trib. Big Otter Creek
Lees Summit Landfill	Jackson	LAN F	Trib. Big Creek
Lees SummitBig Cr WWTP	Jackson	POTW	Big Creek
Leesville R-9 School	Henry	SKL	Trib. Cedar Creek
Leeton WWT Lagoon	Johnson	POTW	Trib. Wade Creek
Les's Auto Center	Henry	CONVN	Trib. Town Creek
Limpus Quarries Inc	Cass	LIM Q	Trib. To East Branch
Limpus Quarries Inc #2	Cass	QUAR	Trib. To Owens Creek
Limpus Quarries Inc #3	Cass	LIM Q	Panther Creek
Limpus Quarries Inc #5	Cass	LIM Q	East Fork Wolf Creek
Lone Jack C-6 Sch Dist WW	Jackson	SKL	Trib. E Br Crawford Cr
Louisburg Dot 100 Ln Rely	Cass	GAS	Trib. Camp Branch
MDNR Harry S Truman St P	Benton	STROF	Trib. Truman Lake
Mfa Oil Co Bulk-Windsor	Henry	TRU S	Trib. E Fk Tebo Creek
Mfa-Clinton Bulk Storage	Henry	SER S	Trib. Town Creek
Mfa-Harrisonville Bulk St	Cass	TRU S	Town Cr East Br
Mma Greenwood Quarry	Cass	QUAR	Big Creek
T.			7
Mma Peculiar Quarry	Cass	LIM Q	East Creek

Montrose WW Lagoon	Henry	POTW	Bear Creek
Oasis MHP	Cass	MHP	Trib. W Fk East Creek
Olson Acres	Cass	SUBD	Trib. West Fork
Panhandle Eastern Louisb	Cass	GAS	Trib. Camp Br
Peculiar Spencer Addition	Cass	SUBD	Trib. E Br/S Grand R.
Peculiar WWTP	Cass	POTW	E Br South Grand R.
Pfizer Inc-Animal Health	Jackson	PHAR	Trib. Cedar Creek
Pickering Place Inc WWTF	Cass	SUBD	East Creek
Pleasant Hill Bank-291 WW	Cass	TRU S	Trib. Polecat Creek
Pleasant Hill WWTF	Cass	POTW	Big Creek
Quiktrip #200	Jackson	SPILL	Trib. Middle Big Creek
Raintree Lake Prop Own As	Jackson	POOL	Raintree Lake
Raymore-Peculiar School	Cass	SKL	Wolf Creek
Save A Dime Rentals Inc	Henry	MHP	Trib. E Fk Tebo Creek
Shadow Hill Deer Cr W	Henry	POTW	Deer Creek
Shadow Hill Deer Cr WWTF	Henry	SUBD	Deer Creek
Shamrock Business Park	Jackson	CBLDG	Trib. Big Creek
Sherwood School Lagoon	Cass	SKL	Knob Creek
Slumber Inn Motel	Cass	MOTEL	Trib. East Branch
Tebo Creek Lodge	Henry	MOTEL	Trib. To Truman Lake
Trophy Estates Subd.	Jackson	SUBD	E. Branch Big Creek
Truman Water Dist #2-Clinton	Henry	SLAND	Trib. Harry S Truman
Truninger Bro Septic-Johnson	Johnson	SLDGE	Trib. L Walnut Creek
Truninger Bros Septic-Cass	Cass	SLDGE	Duncan Branch
Urich WWTF	Henry	POTW	Trib. South Grand R
USAF G-1 - Lowry City	St. Clair	BASE	Trib. Marshalls Creek
USAF I-1 - Quarles	Henry	BASE	Trib. Fields Creek
USAF L-1 - Archie	Cass	BASE	Trib. Sugar Creek
West Point Sub WWTF	Henry	SUBD	Trib. Town Creek
Wheel House Villa/Marina	Camden	SUBD	Lake Of The Ozarks
Williams Natural Gas-Sedalia	Cass	GAS	Trib. S Grand R.
Windsor SE Lagoon	Pettis	POTW	Elm Creek
Windsor SW Lagoon	Henry	POTW	E Fk Tebo Creek
Wngc Lone Jack To St Cha	Jackson	HYDRO	Trib. W Br Crawford Cr

Facility Codes

BASE-Military Base

CAMP-Campgrounds

CBLDG-CommercialPark/Buildings	CIRES-Combined Indus+restrooms
CONVN-Convenience Store	EATS-Restaurant/Bar
GAS-Hydrostatic Testing	GLASS-Manufacture Glass
HOME-Children's Home	HYDRO-hydrostatic testing
INDUS-General Indtry/Ind Park	LAN F-Landfill
LIM Q-Limestone Quarry	MHP-Mobile Home Park
MOTEL-Motel & Hotel	OPIPE-Oil Pipeline
PHAR-Pharmaceuticals	POOL-Swimming pool
POTW-City Waste Water Plant	QUAR-Quarry
RESOR-Resort	SER S-Service/Gas Stations
SKL-School	SLAND-Stormwater Land Disturb.
SLDGE-Sludge disposal/haulers	SPILL-Spill Cleanup
STEAM-Steam Power Plant	STEEL-Steel Mfg.
STOCK-Stockyards	STONE-Stone Crushing Wash
STROF-Stormwater runoff	SUBD-Public Subdivision
TRU S-Truck Stop	WATER-Public Water Treatment Plant

Station: EPA 280518 (S. Grand R. -Henry Co. Hwy. K Ht-18) Period: 1991-1995

	Standard					Measure	
Parameter	AQL	DWS	LWW	BTG	WBC	Min-Max	Exceedence
Temperature (°F)	90.0					39.2-86.0	0/53
(warm water fishery)	Max						
рН	6.5-9.0					6.8-8.6	0/53
Oxygen, dissolved (mg/L)	5.0					2.5-17.2	6/27
(warm water fishery)	Min						
Coliform, fecal					200		
(colonies / 100 ml)							
Nitrogen, Total Ammonia	$0.1-50.6^{1}$					0.02-0.33 ^K	0/27
(mg/L as N)							
Phosophorus, Total ³							
(mg/L as P)							

Depth 0.1-5.0

Station: EPA 280520 (South Grand at Dayton, Mo. HT-20) Period: 1991

	Standard					Measure	
Parameter	AQL	DWS	LWW	BTG	WBC	Min-Max	Exceedence
Temperature (°F)	90.0					73.9	0/1
(warm water fishery)	Max						
рН	6.5-9.0					7.9	0/1
Oxygen, dissolved (mg/L)	5.0					7.4	0/1
(warm water fishery)	Min						
Coliform, fecal					200		
(colonies / 100 ml)							
Nitrogen, Total Ammonia	$0.1-50.6^{1}$						
(mg/L as N)							
Phosophorus, Total ³							
(mg/L as P)							

Station: EPA 280530 (Tebo Creek at Henry County Hwy. V HT-32) Period: 1994

	Standard					Measure	
Parameter	AQL	DWS	LWW	BTG	WBC	Min-Max	Exceedence
Temperature (°F)	90.0					37.94-85.8	0/34
(warm water fishery)	Max						
рН	6.5-9.0					6.6-8.0	0/27
Oxygen, dissolved (mg/L)	5.0					0.4-13.5	1/29
(warm water fishery)	Min						
Coliform, fecal					200		
(colonies / 100 ml)							
Nitrogen, Total Ammonia	$0.1-50.6^{1}$					0.01-0.17	0/27
(mg/L as N)							
Phosophorus, Total ³							
(mg/L as P)							

Depth 0.1-6.1

Station: USGS 06921881 (South Grand River at Grand River Church) Period: 1997-2000

	Standard					Measure	
Parameter Parame	AQL	DWS	LWW	BTG	WBC	Min-Max	Exceedence
Temperature (°F)	90.0					32.9-86.0	0/39
(warm water fishery)	Max						
рН	6.5-9.0					7.7-8.5	0/64
Oxygen, dissolved (mg/L)	5.0					3.9-19.2	3/38
(warm water fishery)	Min						
Coliform, fecal					200	10-7100	
(colonies / 100 ml)							
Nitrogen, Total Ammonia	$0.1-50.6^{1}$					0.01-0.17	0/27
(mg/L as N)							
Phosophorus, Total ³						0.05-0.7	14/26
(mg/L as P)							

N/A Not Available	
k Non-ideal count of colonies (too large a sample, colonies merged)	

e Laboratory estimated value.

N/O No observations

- ¹ Based on maximum chronic and acute standards for cold-water fishery. Levels are pH and temperature dependent. For specific criteria at varying pH and temperatures consult Table B of the Rules of the Department of Natural Resources Division 20-Clean Water Commission Chapter 7-Water Quality.
- ² Based on maximum chronic and acute standards for general warm-water fishery. Levels are pH and temperature dependent. For specific criteria at varying pH and temperatures consult Table B of the Rules of the Department of Natural Resources Division 20-Clean Water Commission Chapter 7-Water Quality.
- ³ State standard for phosphorus is currently unavailable. The Environmental Protection Agency currently recommends a maximum of 0.1mg/L for rivers (Christensen and Pope 1997).
- ⁴ Based on maximum chronic and acute standards for all waters. Levels are hardness dependent. For specific criteria at varying hardness consult Table A of the Rules of the Department of Natural Resources Division 20-Clean Water Commission Chapter 7-Water Quality.
- ⁵ Based on maximum chronic and acute standards for cold water fishery. Levels are hardness dependent. For specific criteria at varying hardness consult Table A of the Rules of the Department of Natural Resources Division 20-Clean Water Commission Chapter 7-Water Quality.

Table Wq06. Fish kill and water pollution investigations within the South Grand Watershed in Missouri since 1990 (MDC 2003c).

Date	County	Stream/Water Body	Cause	Fish	Damage
				Kill	
1990	Cass	Tributary of East Branch of South Grand R.	Suspected quarry fines	No	> 1/2 mile
1990	•	Deepwater Creek (Montrose Lake) (UPDATE	Low dissolved oxygen (inadequate flow)	Yes	0.1 miles
1991	Henry	Coal Creek	Anhydrous ammonia	No	0 miles
1991	Cass	West Fork of East Creek	Unknown	Yes	Unknown
1992	Cass	Poney Creek	Crude oil	No	1 mile
1992	Cass	Town Creek/Muddy Creek	Raw/partially treated sewage	Yes	1.25/2.75 miles
1992	Cass	Duncan Branch	Raw sewage	Yes	1/4 mile
1992	Cass	East Creek	Natural gas	No	N/A
1992	Cass	Middle Big Creek	Raw sewage	Yes	<1.0 miles
1992	Cass	Tributary to Town Creek	Unknown	No	Unknown
1992	Benton	Barkers Creek (tributary to)	Hog manure	No	3/4 miles
1993	Cass	Middle Big Creek	Raw/partially treated sewage	Yes	1/4 mile
1994	_	Deepwater Creek (Montrose Lake)	Low dissolved oxygen (inadequate flow	Yes	1/4 mile
1996	Cass	Middle Big Creek/Big Creek	Elevated ammonia	Yes	6.9/26.4 miles
1996	Henry	Deepwater Creek	Dam operation; stranding & abrasion	Yes	0.5 miles
1996	Cass	Middle Big Creek	Low dissolved oxygen/elevated ammonia	Yes	4.1 miles
1996	Benton	Barker's Creek	Hog manure	No	3/4 mile
1996	Cass	Middle Big Creek	Dewatering of stream	Yes	0.1 mile
1996	Cass	Town Creek	Soap	No	>1/4 mile
1997	Johnson	Lost Creek	Poorly treated sewage effluent	No	1 1/2 miles
1997	Johnson	Little Walnut Creek	Milk and diesel fuel	No	<1/4 mile
1997	Henry	Town Creek	Swine waste nutrients and sediment	No	1/4+ mile
1997	Cass	Coldwater Creek	Crude Oil	No	0.1 mile
1997		Deepwater Creek (Montrose Dam)	Low DO caused by broken siphon tube	Yes	1 mile
1997	Cass	South Fork Grand River	Diesel Fuel	No	
1997	St. Clair	Monegaw Creek	Poorly treated sewage	No	1.25 miles
1998	Henry	Tributary to Rose Creek	Dairy manure	No	1.2+ miles
1998	Henry	Tebo Creek Tributary	Domestic sewage.	No	<1 mile

1998	1	East Branch of South Grand River Tributary	Suspected - sewage	Yes	6 miles\1.5 acres
1999	Henry	Deepwater Creek	Dewatering	No	1.5 miles
2000	Henry	Sand Creek	Roundup Concentrate	Yes	0.1 miles

Table Wq07. Water withdrawals by use category within the South Grand Watershed in 1995 (USGS 1998a).

Use Category	Millions of Gallons Per Day
Commercial	0.17
Domestic	0.73
Industrial	0.09
Thermoelectric Power	354.90
Mining	0.00
Livestock	2.39
Irrigation	2.11
Hydroelectric (instream)	0.00
Reservoir Evaporation	5.82
Total	366.24

Table Wq08. Major water users within the South Grand Watershed in Missouri (MDNR 2003b).

Owner	Source	Total Gallons	Acres
		Pumped in 2001	Irrigated
City Of Adrian	Surface Water	123,977,700	0
City Of Archie	Surface Water	28,229,600	0
City Of Butler	Surface Water	316,008,170	0
City Of Chilhowee	Ground Water	7,950,800	0
City Of Garden City	Surface Water	49,880,600	0
City Of Green Ridge	Ground Water	22,500,000	0
City Of Harrisonville	Surface Water	458,356,000	0
City Of Leeton	Ground Water	21,042,400	0
City Of Lincoln	Ground Water	32,850,205	0
City Of Lowry City	Ground Water	33,316,800	0
City Of Warsaw	Ground Water	29,793,600	60
City Of Windsor	Ground Water	78,000,000	0
Dept. Of The Army (17ff)	Ground Water	47,183,000	0
Harry S. Truman Pwsd #2	Ground Water	0	0
Harry S. Truman Pwsd #2	Surface Water	140,948,700	0
Henry County Water Company	Surface Water	363,000,000	0
Kansas City Power & Light	Surface Water	135,148,362,000	114
P.W.S.D. #7 Of Cass County	Surface Water	133,656,786	0
Pwsd #2 Of Johnson County	Ground Water	264,343,000	0
U.S. Air Force	Ground Water	252,338,400	0
U.S. Army C.O.E	Ground Water	262,100	0
U.S. Army C.O.E.	Ground Water	3,465,200	0
U.S. Army C.O.E. (Hydroelectric)	Surface Water	1,782,626,000,000	0
Total Public		1,920,181,465,061	174
Total Private	Ground Water	1,109,477,040	110
Total Private	Surface Water	221,220,000	1,451
Watershed Total		1,921,512,162,101	1,735